

Summary of the NASA Large Constellations Parametric Study

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In recent years, several commercial companies have proposed telecommunications constellations consisting of hundreds to thousands of 100-to-300-kg class spacecraft in low Earth orbit (LEO, the region below 2000-km altitude). If deployed, such large constellations (LCs) will dramatically change the landscape of satellite operations in LEO. From the large number of spacecraft and large amount of mass involved, it is clear that the deployment, operations, and frequent de-orbit and replenishment of the proposed LCs could significantly contribute to the existing orbital debris problem.

To better understand the nature of the problem, the NASA Orbital Debris Program Office (ODPO) recently completed a parametric study on LCs. The objective was to quantify the potential negative debris-generation effects from LCs to the LEO environment and provide recommendations for mitigation measures. The tool used for the LC study was the ODPO's LEO-to-GEO Environment Debris (LEGEND) numerical simulation model, which has been used for various mitigation and remediation studies in the past. For the LC study, more than 300 scenarios based on different user-specified assumptions and parameters were defined. Selected results from key scenarios are summarized in this paper.